



**ORGANISATION EUROPEENNE POUR LA RESEARCH NULCEAIRE
EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH**

Laboratoire européen pour la physique des particules

European laboratory for particle physics

TH DIVISION, CERN, CH-1211 GENEVA 23, SWITZERLAND

PHONE +41-22-767-2447 SECRETARIAT +41-22-767-4242 FAX +41-22-767-3850

Rocky.Kolb@cern.ch

September 16, 2002

Dr. Anne Kinney
Director, Astronomy and Physics Division
Code S
NASA
Washington, DC 20546

Dear Anne:

The Structure and Evolution of the Universe Subcommittee (SEUS) met at NASA Headquarters, on August 8-9, 2002. In attendance were Joel Bregman, Charles Dermer, Kathy Flanagan, Tim Heckman, Paul Hertz, (Executive Secretary), Jacqueline Hewitt, Rocky Kolb, (Chair), Dan Lester, Brad Peterson, Sterl Phinney, Simon Swordy, Nick White, Ned Wright, and Harold Yorke. Lynn Cominsky was unable to attend the meeting. Also in attendance as observers were several members of the Roadmap team who are not SEUS members. (The Roadmap team met at NASA Headquarters on August 7 in preparation for the SEUS meeting.)

The SEUS meeting directly followed the summer meeting of the Space Science Advisory Committee (SScAC) meeting held August 5-7, 2002. Three particular issues discussed at the SScAC meeting were brought forward for consideration by SEUS.

The first issue involved cost caps for missions. While the Subcommittee strongly supports the concept of cost-capped mission opportunities in general and the NASA Explorer Program in particular, members are concerned about whether or not the current cost caps for the specific programs (MIDEX, SMEX, etc.) optimize the science return. Specifically, we are concerned whether science capabilities for missions in various categories have eroded with time as launch vehicle costs, spacecraft costs, and contingency requirements have grown faster than budget caps. After the base costs have been met, is there enough money left to carry out a science program?

A second related issue is the future availability of small launch vehicles. SScAC has flagged this as an area of growing concern. The consensus of SEUS is that this might well be a very serious problem for the future of SEU science. After a wide-ranging discussion, no "quick fix" solutions emerged. The idea of co-manifesting multiple payloads on a single large launcher did not seem attractive to the Subcommittee because of varying orbital parameters needed by different missions and because tying together schedules from multiple missions will cause delays and drive costs higher.

The above two tactical issues tie into the strategic issue of maximizing science-per-dollar in the Explorer Program. The present mix of different Explorer classes has served the community well. However, it may be that the current program mix will not be optimal for the future. Small Explorer missions have been very successful, but perhaps the best smaller, cheaper missions have been done.

We suggest that OSS solicit feedback from PIs who submitted proposals in response to Explorer AOs to determine what particular problems were encountered in meeting existing cap requirements. SEUS intends to discuss this issue at future meetings and to develop a recommendation regarding procedures for determining mission cost caps.

The third issue brought forward from SScAC was the role of Education and Public Outreach (E/PO) in the Office of Space Science. There is now an agency-wide team looking at education, and there will be a new Education Enterprise. Presently, OSS education is integrated throughout Space Science. Under the Office of Space Science, E/PO is woven in an integrated way throughout SEUS activities; e.g., it is a component of missions and their guest investigations. This approach encourages direct participation by space scientists. As a result, SEU scientists integrate E/PO into their daily activities, from impromptu visits and talks to formal partnerships with educators. One of the concerns expressed by SEUS was that the entire OSS education effort might migrate to the new Education Enterprise. It was reported that the OSS Associate Administrator recognized the value of the OSS education effort, and that OSS education activities per se should not be moved out of the Enterprise. The goal is for education in the other Enterprises to be ramped up to be comparable to what is being done in OSS. However, there is discussion about moving Dr. Rosendhal and his group to the new organization. Several members expressed concern that the OSS activities could be “lost” to the new Enterprise. SEUS felt that space science education should not be separated from the content providers (OSS scientists), and that it is important that the OSS E/PO should stay within the OSS organization.

It is the opinion of the SEUS that moving OSS E/PO to an Education Enterprise outside of Code S will have a negative impact at the most basic level, tending to weaken the interface between scientists and educators.

The SEUS received a report from the Science Archive Working Group (SAWG) from Joel Bregman (Chair), and a report from the Astronomy & Physics Working Group (APWG) from Kathryn Flanagan (Co-Chair). The SEUS was pleased with the operation of these working groups. Their reports are included in this report.

Dr. Steve Smith provided an update on the Ultra-Long Duration Balloon (ULDB) program. He discussed the balloon program metrics, the Trans-Iron Galactic Element Recorder (TIGER) flight in Antarctica, and the nature of ULDBs, mission management, systems development, current status, and issues. Balloons have been getting considerable attention for planetary exploration. In addition, Boomerang was a major science and media success. In 2001, the balloon program produced 9% of the science for the Agency, according to the *Science News* metric (oft-quoted by Associate Administrator Ed Weiler). Dr. Smith showed the balloon missions by science disciplines. This past year, the number of missions was down to about 15. Although the number of flights has decreased, the average flight hours have been going up. TIGER provided excellent return on science and was a very successful flight (31 days, 20 hours). ULDB has been envisioned as a new NASA science mission carrier. It is growing in its possibilities for application. About 120 days is the duration target. ULDB provides low cost, quick response access to space. It is capable of being flown anywhere in the world, but it will be used primarily in the southern hemisphere due to geopolitical factors. About 1000 kg has been targeted for the science payload. Global telecom is achieved through TDRSS High Gain Antenna. The power system is a solar array with NiMH or lithium ion batteries. Altitude is about 33.4 km. The reason for ULDB is stability

and duration. Dr. Smith discussed the balloon mission management philosophy. There is a “design to capability” philosophy for SR&T and a “design to requirement” philosophy for Explorers. For the conventional LDB, it would be business-as-usual. For ULDB, there would be an oversight board. For Explorers, there will be a much stronger mission management structure, reporting to the Explorers office. The ULDB-SR&T mission cost is about \$3.7M for a “new hardware” flight. Reflight would be about \$2M per flight. A ULDB Explorer total cost (primary, reflight, and contingency) would be about \$20.5M for two flights.

Dr. Smith discussed some of the technology in ULDB. One of the biggest developments has been in the area of experimental materials. Other technology focus areas include performance modeling, support systems, balloon design and development, and non-linear membrane structural analysis. Dr. Smith discussed the preliminary and full-scale flight tests. Two balloons will be launched to demonstrate that ULDB is a viable vehicle. Issues include international and domestic agreement, over-flight safety restrictions in South Africa and South America, and future funding to maintain technical capabilities.

SEUS discussed how a ULDB program could play a role in fulfilling SEU science goals. The committee felt that balloons potentially could provide an excellent platform for a lot of SEU science, e.g., x-ray and far ultraviolet. It was noted that another advantage of the balloon program is the training of future Principal Investigators (PIs) for flight missions. This is invaluable. Currently, there is no dedicated mechanism to fund balloon payloads. Funding ULDB payloads through the SR&T program is not really viable—there is not enough money. The SEUS discussed the possibility of ULDB missions as MoO’s under Explorer. Dr. Hertz noted that although no balloon proposals have yet been selected, MoO’s have done relatively well over the last year of Explorer competitions. Another possibility is a dedicated competition for ULDB payloads.

The SEUS felt that people are not well aware of the capabilities of ULDB’s. For the next meeting, Dr. Swordy has agreed to prepare a one-page summary of the science that could be done on balloon platforms. Some technologies could perhaps move up the chain through use of ULDB’s as a platform for technology demonstration. It was also discussed that a ULDB program might mitigate the problem of space access for small platforms. The SEUS intends to pursue the question of how best to take advantage of ULDB opportunities.

The SEUS recommends that the Division develop a “capability fact-sheet” on ULDB’s for a wider dissemination to the community. For the December SEUS meeting, we request that the Division present a briefing on what a ULDB program would look like in terms of potential science that could be done, cost, AO’s, technology development, impact to other programs, etc.

Dr. Sterl Phinney, Chair of the Roadmap Team, reported on the status of the SEU roadmap. He reviewed the charter and history of the roadmap process. White papers on most missions in the previous roadmap were solicited. In addition, the technology group solicited white papers on technology needs. The inputs were integrated into a draft roadmap, which was presented to the SEUS for concept approval at their April meeting. The Team felt that the most saleable and coherent story focuses on black holes and the early universe. The work of Einstein links these. Dr. Phinney briefly reviewed the parts of the roadmap. Part I includes those missions with the highest priority (Beyond Einstein); Part II includes the rest of SEU science (Cycles of Matter and Energy).

Beyond Einstein includes the great observatories (Con-X and LISA), an Einstein probe line (a dark energy mission, a black-hole finder, and a CMB polarization mission), and the ultimate vision missions of the Big Bang Observatory (a LISA follow on) and a Black Hole Imager. Part III of the roadmap contains supporting materials. The bulk of R&A was put there, along with the Explorer Program. E/PO is included in Part I.

The SEUS discussed the timing of the release of the roadmap to the community and to the public. The SEUS strongly recommends an aggressive “roll out.” SEUS supports the development of presentation materials on the Roadmap that would be available to the community for briefing purposes. In addition, we request a one-page “fact sheet” available for community use. We also note that it may be possible to capitalize on the upcoming centennial of the Special Theory of Relativity would be a good idea.

The SEUS discussed coordination of the SEU roadmap with the Origins roadmap in a telephone conference with Alan Dressler, chair of *Origins*. The exchange of information was very useful.

The SEUS heard two mission updates. Dr. Neil Gehrels, Swift PI, briefed the SEUS on the Swift mission and Dr. Jeff Kolodziejczak, Project Scientist, briefed the SEUS on the status of the GP-B mission. The SEUS very much looks forward to the launch of these two missions.

The SEUS appreciates your involvement during the meeting and your support during the Roadmap process.

The next SEUS meeting is scheduled for December 3-4, 2002, in Washington. The meeting will be a joint SEUS-OS meeting.

Sincerely,

Rocky Kolb
Chair, Structure and Evolution of the Universe Subcommittee